

Application No.: 10/718,466

Docket No.: JCLA11486

REMARKS**Present Status of the Application**

The Office Action mailed Sep. 20th, 2004 rejected all presently-pending claims 1-21. Specifically, the Office Action rejected claims 1, 2, 6, 8 and 11-16 under 35 U.S.C. 102(b), as being anticipated by Tolles et al. (U.S. 6,220,942). The Office Action also rejected claims 18-20 under 35 U.S.C. 102(b) as being anticipated by Tolles et al. (U.S. 6,217,426). The Office Action rejected claims 3-5, 7, 9-10, 17 and 21 under 35 U.S.C. 103(a), as being unpatentable over Tolles et al. (U.S. 6,220,942) in view of Wang (U.S. 6,666,751). Applicants have amended claims 1, 6, 11, 14, 18 and 19 and canceled claims 5, 10 and 21 to improve clarity. After entry of the foregoing amendments, claims 1-4, 6-9 and 11-20 remain pending in the present application, and reconsideration of those claims is respectfully requested.

Summary of Applicant's Invention

The Applicant's invention is directed to a polishing element possessing a polishing sub-pad placed under a fixed abrasive polishing pad and above a polishing platen for a **non-slurry polishing process**. Because of the undulating profile of upper surface of the polishing sub-pad, lower surface of the polishing sub-pad, lower surface of the fixed abrasive polishing pad or upper surface of the polishing platen, the fixed abrasive polishing pad will cave in a little into the grooves on the upper surface of the polishing sub-pad, on the lower surface of the polishing sub-pad, on the lower surface of the fixed abrasive polishing pad or on the upper surface of the

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polishing platen to form an undulating surface. Thus, with a wave-like undulation on the upper surface of the fixed abrasive polishing pad, the protruding portion of the binder in the polishing pad can be easily scrapped away to expose the polishing particles. This facilitates the contact of the polishing particles with the polished layer and hence increases the polishing rate of the polishing element. Furthermore, as the surface of the polished layer is gradually smoothed out, the polishing element still continues to provide a relatively high polishing rate due to the presence of an undulating polishing pad.

Discussion of Office Action Rejections

The Office Action rejected claims 1, 2, 6, 8 and 11-16 under 35 U.S.C. 102(b), as being anticipated by Tolles et al. (U.S. 6,220,942). The Office Action also rejected claims 18-20 under 35 U.S.C. 102(b) as being anticipated by Tolles et al. (U.S. 6,217,426). The Office Action further rejected claims 3-5, 7, 9-10, 17 and 21 under 35 U.S.C. 103(a), as being unpatentable over Tolles et al. (U.S. 6,220,942) in view of Wang (U.S. 6,666,751).

Applicants respectfully traverse the rejections and respectfully submit that claims 1, 6, 11, 14 and 18 have already clearly defined the method according to the present invention. As stated above, claims 1, 6, 11, 14 and 18 recite:

Claim 1. A polishing element for a **non-slurry polishing process**, comprising:

a polishing platen;

a **fixed abrasive polishing pad**; and

a polishing sub-pad set up over the polishing platen and below the polishing pad,

wherein a first surface of the polishing sub-pad interfaces with the fixed abrasive polishing pad and a second surface of the polishing sub-pad

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interfaces with polishing platen, and either the first surface or the second surface of the polishing sub-pad is an undulating surface, and **an upper surface of the fixed abrasive polishing pad undulates with the undulating surface when the fixed abrasive polishing pad is subjected to a pressure.**

Claim 6. A polishing element for a **non-slurry polishing process**, comprising:

a polishing platen;

a polishing sub-pad set up over the polishing platen; and

a fixed abrasive polishing pad set up over the polishing sub-pad;

wherein a first surface of the polishing sub-pad interfaces with the fixed abrasive polishing pad and a second surface of the polishing sub-pad interfaces with polishing platen, a third surface of the fixed abrasive polishing pad interfaces with the polishing sub-pad and a fourth surface of the polishing platen interfaces with the polishing sub-pad, and the first surface, the second surface, the third surface or the fourth surface is a undulating surface, and **an upper surface of the fixed abrasive polishing pad undulates with the undulating surface when the fixed abrasive polishing pad is subjected to a pressure.**

Claim 11. (currently amended) A polishing platen for assembling with a polishing sub-pad and **a fixed abrasive polishing pad** to form a polishing element for a **non-slurry polishing process**, wherein the polishing platen has a body, and a surface of the polishing platen interfaces with the polishing sub-pad such that the surface is an undulating surface, and **an upper surface of the fixed abrasive polishing pad undulates with the undulating surface when the fixed abrasive polishing pad is subjected to a pressure.**

Claim 14. (currently amended) A polishing sub-pad for assembling with a polishing platen and **a fixed abrasive polishing pad** to form a polishing element used in a **non-slurry polishing process**, wherein the polishing sub-pad has a body, and a first surface of the polishing sub-pad interfaces with the fixed abrasive polishing pad and a second surface of the polishing sub-pad interfaces with the polishing platen such that at least one of the first surface or the second surface of the polishing sub-pad is an undulating surface, and **an upper surface of the fixed abrasive polishing pad undulates with the undulating surface when the fixed abrasive polishing pad is subjected to a pressure.**

Claim 18. (currently amended) **A fixed abrasive polishing pad** for assembling with a polishing platen and a polishing sub-pad to form a polishing element for a **non-slurry polishing process**, wherein the fixed abrasive polishing pad has a body, and a surface of the fixed abrasive polishing pad interfaces with the polishing sub-pad such that the surface is an undulating surface, and **an upper**

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surface of the fixed abrasive polishing pad undulates with the undulating surface when the fixed abrasive polishing pad is subjected to a pressure.

(Emphasis added). Applicants assert that claims 1, 6, 11, 14 and 18 patently define over the cited art for at least the reason that the cited art fails to disclose at least the features emphasized above.

In the present invention, the polishing element is used in a non-slurry polishing process with using the fixed abrasive polishing pad. By using the polishing sub-pad with either undulating upper surface or undulating lower surface or using the polishing platen with the undulating upper surface or using the fixed abrasive polishing pad with an undulating lower surface, when the fixed abrasive polishing pad is subjected to a pressure from a wafer, the upper surface in contact with the wafer undulates with the undulating upper surface of the polishing sub-pad, the undulating lower surface of the polishing sub-pad, the undulating upper surface of the polishing platen or the undulating lower surface of the fixed abrasive polishing pad. Therefore, while a non-slurry polishing process is performed, the protruding portion of the binder wrapping a lot of polishing particles in the fixed abrasive polishing pad is scrapped away to expose the polishing particles for further polishing the wafer. Hence, even though the surface of the fixed abrasive polishing pad is getting flat during the non-slurry polishing process, the undulating upper surface of the polishing sub-pad, the undulating lower surface of the polishing sub-pad, the undulating upper surface of the polishing platen or the undulating lower surface of the fixed abrasive polishing pad still can provide protruding supports to form an undulating upper

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surface of the fixed abrasive polishing pad for continuously polishing the wafer in a steady and high polishing rate.

In cited art, U.S. Patent 6,220,942, Tolles et al. provide a polishing platen 41/mat 100 with patterned surface for mounting a pad, wherein the raised portions/protrusions of the patterned surface of the polishing platen 41/mat 100 ensures sufficient rigidity while the grooves of the patterned surface of the polishing platen 41/mat 100 allow the proper proportion of pad compliance to accommodate a substrate's varying topography (col. 5, lines 15-29 and col. 6, lines 33-46). Tolles et al. further emphasize that the polishing mat they provide is focusing on solving the problem of the substrate and die un-uniformity happening when the polishing platen/mat is flat (col. 2, lines 14-26 and lines 61-65). In addition, the polishing mat provided by Tolles et al. is used in a chemical-mechanical polishing process with using slurry (col. 4, lines 60-67).

In cited art, U.S. Patent 6,217,426, Tolles et al. also provide a polishing pad with a deflection area including a raised portion and a recess displacement portion, wherein the bulk of the pad comprising primarily of the base 45/112/134 ensures sufficient rigidity (stiffness) while the channels 62/102/122 and plurality of elongated slanted protrusions 60/110/124 allow the proper proportion of pad compliance (flexibility) to accommodate a substrate's varying topography (col. 9, lines 18-29). Similar to what has been mentioned above, Tolles et al. emphasize that the polishing pad they provide is focusing on solving the problem of the substrate and die un-uniformity happening when the polishing platen/mat is flat (col. 1, lines 66-col. 2, lines 65). In addition, the polishing mat provided by Tolles et al. is used in a chemical-mechanical polishing process with using slurry (col. 6, lines 24-32).

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It is clear that Tolles et al. provide a patterned polishing platen/ mat and polishing pad to enhance both stiffness and flexibility of the polishing pad so that the polishing pad can be more compliance to accommodate the substrate's varying topography. Hence, the within substrate and within die uniformity of the polishing process can be improved. However, it is well known in the art that the polishing theorem of the slurry polishing process is different from that of the non-slurry polishing process. In slurry polishing process, the polishing process is driven by the slurry and the relative movement between the polishing pad and the wafer. Therefore, the slurry distribution and the compliance of the polishing pad for accommodating to the substrate's varying topography are key issues for affecting the polishing uniformity.

Nevertheless, for a non-slurry polishing process, the fixed abrasive pad made of binder wrapping a lot of polishing particles is used to perform the polishing process. By scrapping away the binder of the fixed abrasive polishing pad, the polishing particles are exposed to polish the target wafer. That is, the fixed abrasive polishing pad is consumed from time to time during the non-slurry polishing process. Therefore, it is important to maintain the undulating level of the upper surface of the fixed abrasive polishing pad for keeping the polishing rate steady and high during the polishing process.

It is obvious that Tolles et al. neither mention the use of the fixed abrasive polishing pad nor suggest that the polishing pad positioned over the polishing pad will undulate with the raised-and-recess profile of patterned polishing platen when the polishing pad is subjected to a pressure. Moreover, Tolles et al. also silence about the problem about dropping down polishing rate caused due to flattened fixed abrasive polishing pad. Hence, Tolles et al. do not teach or suggest that the

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patterned polishing platen/mat and the polishing pad can solve the problem of polishing rate dropping down.

Furthermore, the Office Action asserted that *"it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilize fixed abrasive, since it have been held to be within the general skill of a worker in the art to select a known material on the basis of it suitability for the intended use as a matter of obvious design choice"*.

However, the Applicants respectfully disagree with this assertion. The hindsight rationalization proposed by the Office Action is not mentioned in the cited references, U.S. Patent 6,220,942 and U.S. Patent 6,217,426. Since the motivation of both cited references is to improve the within substrate and within die uniformity, there is no motivation suggested or taught by Toller et al. to replace the polishing pad used in chemical-mechanical polishing process accompanying with slurry by the fixed abrasive polishing pad. It is also respectfully believed that the Office Action has based on "hindsight" in judgement.

For at least the foregoing reasons, Applicants respectfully submit that independent claims 1, 6, 11, 14 and 18 patently define over the prior art references, and should be allowed. For at least the same reasons, dependent claims 2-4, 7-9, 12-13, 15-17 and 19-20 patently define over the prior art as well.

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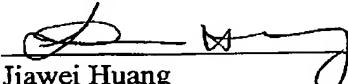
CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims 1-4, 6-9 and 11-20 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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